

CLAIMS

1. A coated cutting tool member whose hard coating layer exhibits a superior chipping resistance during a high speed and severe cutting operation, the coated cutting tool member comprising:
 - a hard substrate; and
 - a hard coating layer of a nitride compound containing Ti, Al, and Zr, which is formed on a surface of the hard substrate using a physical vapor deposition method at an overall average thickness of 1 to 15 μm , wherein
 - 10 the hard coating layer has a component composition profile in which maximum Al containing points and minimum Al containing points appear alternatingly and repeatedly at a predetermined interval in a direction of thickness of the hard coating layer, and the amount of contained Al component continuously varies from the maximum Al containing points to the minimum Al containing points and from the minimum Al containing points to the maximum Al containing points,
 - 15 the maximum Al containing points satisfy a composition formula of $(\text{Ti}_{1-X+Y}\text{Al}_X\text{Zr}_Y)\text{N}$ (where X indicates an atomic ratio of 0.45 to 0.65, and Y indicates an atomic ratio of 0.01 to 0.15) and the minimum Al containing points satisfy a composition formula of $(\text{Ti}_{1-X+Y}\text{Al}_X\text{Zr}_Y)\text{N}$ (where X indicates an atomic ratio of 0.15 to 0.40, and Y indicates an atomic ratio of 0.01 to 0.15), and
 - 20 a distance between one of the maximum Al containing points and adjacent one of the minimum Al containing points is from 0.01 to 0.1 μm .
2. A coated cutting tool member exhibiting a superior wear resistance, comprising:
 - a hard substrate; and

a hard coating layer of one of a nitride compound containing Ti and Al, and a carbonitride compound containing Ti and Al, which is formed on a surface of the hard substrate using a physical vapor deposition method at an overall average thickness of 1 to 10 μm , wherein

5 the hard coating layer comprises Zr at an atomic ratio of 0.002 to 0.1, and at least one of Y and Ce at an atomic ratio of 0.0005 to 0.05 in a coexistence state.

3. A coated cutting tool member according to claim 2, wherein the hard coating layer has a component composition profile in which maximum Al containing points and
10 minimum Al containing points appear alternatingly and repeatedly at a predetermined interval in a direction of thickness of the hard coating layer, and the amount of contained Al component continuously varies from the maximum Al containing points to the minimum Al containing points and from the minimum Al containing points to the maximum Al containing points.

15 4. A coated cutting tool member according to claim 3,
 wherein maximum Al containing points contain Al component at an atomic ratio of 0.40 to 0.60 with respect to entire metal components, and the minimum Al containing points contain Al component at an atomic ratio of 0.05 to 0.25 with respect to entire metal
20 components, and

 wherein a distance between one of the maximum Al containing points and adjacent one of the minimum Al containing points is from 0.01 to 0.1 μm .

25 5. A coated cutting tool member according to any one of claims 1 to 4, wherein the hard substrate is made of tungsten carbide based hard metal.

6. A coated cutting tool member according to any one of claims 1 to 4, wherein the hard substrate is made of titanium carbonitride based cermet.
- 5 7. A coated cutting tool member according to any one of claims 1 to 4, wherein the hard substrate is made of cubic boron nitride based sintered material.
8. A method for forming a hard coating layer exhibiting a superior chipping resistance during a high speed and severe cutting operation on a surface of a cutting tool substrate, the method comprising:
- 10 mounting the cutting tool substrate on a turntable housed in an arc ion plating apparatus at a position radially away from a center axis of the turntable in a manner rotatable about an axis of the cutting tool substrate;
- 15 producing a nitrogen gas atmosphere as the reaction atmosphere in the arc ion plating apparatus; and
- generating arc discharge between a cathode electrode of a Ti-Al-Zr alloy piece for forming maximum Al containing points and an anode electrode, and between another cathode electrode of a Ti-Al-Zr alloy piece for forming minimum Al containing points, which is disposed so as to oppose to the other cathode electrode with respect to the
- 20 turntable, and another anode electrode, so that a hard coating layer of a nitride compound containing Ti, Al, and Zr having overall average thickness of 1 to 15 μm is formed, by a physical vapor deposition method, on the surface of the cutting tool substrate being turned while rotating on the turntable about an axis of the cutting tool substrate, wherein
- the hard coating layer has a component composition profile in which the
- 25 maximum Al containing points and the minimum Al containing points appear alternatingly

and repeatedly at a predetermined interval in a direction of thickness of the hard coating layer, and the amount of contained Al component continuously varies from the maximum Al containing points to the minimum Al containing points and from the minimum Al containing points to the maximum Al containing points,

5 the maximum Al containing points satisfy a composition formula of $(Ti_{1-(X+Y)}Al_xZr_y)N$ (where X indicates an atomic ratio of 0.45 to 0.65, and Y indicates an atomic ratio of 0.01 to 0.15) and the minimum Al containing points satisfy a composition formula of $(Ti_{1-(X+Y)}Al_xZr_y)N$ (where X indicates an atomic ratio of 0.15 to 0.40, and Y indicates an atomic ratio of 0.01 to 0.15), and

10 a distance between one of the maximum Al containing points and adjacent one of the minimum Al containing points is from 0.01 to 0.1 μm .

9. A coated cutting tool member according to claim 8, wherein the hard substrate is made of tungsten carbide based hard metal.

15 10. A coated cutting tool member according to claim 8, wherein the hard substrate is made of titanium carbonitride based cermet.

20 11. A coated cutting tool member according to claim 8, wherein the hard substrate is made of cubic boron nitride based sintered material.